

Resistors in Series and Parallel Circuits

(Using CCK and equipment)

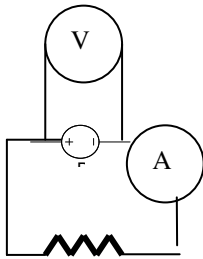
Learning Goals: Students will be able to

- Discuss basic electricity relationships in series and parallel circuits
- Analyze the differences between real circuits and the simulated ones
- Build circuits from schematic drawings
- Use a multimeter to take readings in circuits.
- Provide reasoning to explain the measurements in circuits.

I. Get three real resistors with different color codes. Label them 1,2 and 3 with masking tape.

a. Measure their resistances' with the multimeter set to ohms. Make sure there is **no** power or you will blow the meter fuse. Record the measured resistances in a table like the one below.

b. Then wire one resistor to a power supply set on about 3 volts as shown below. Measure and record the current and voltage. Calculate the resistance using $V=IR$. Record this in the “powered” column. Repeat with each of the other two resistors.



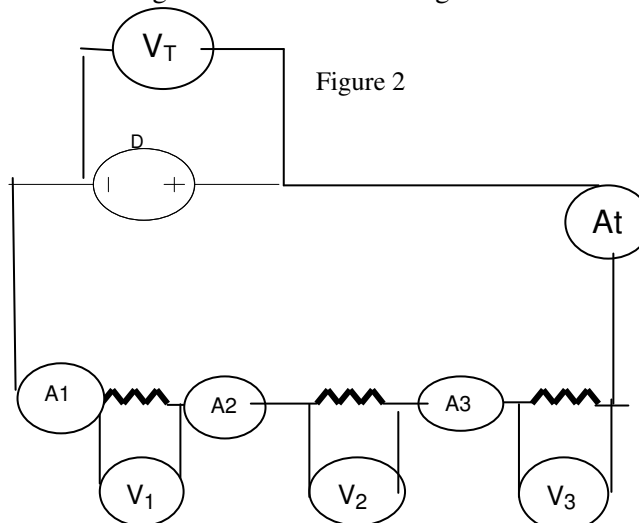
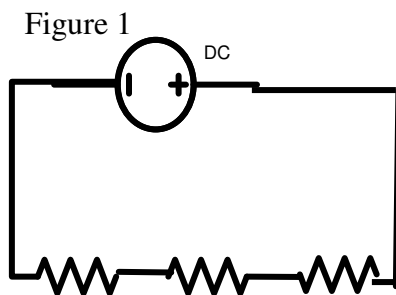
#	measured R (Ω) (no power)	voltage(V)	current (A)	Calculated R(Ω) (powered)
1				
2				
3				

c. What is the relationship between the resistance without power and with? What do you think might be causing the changes in resistance?

d. Check to see how the simulation compares to reality in terms of resistance and describe your findings.

II. Series Circuit

Wire the circuit figure 1 using the same resistors you used in part II. Use just one multimeter again, moving it to take readings in the different places seen in figure 2. Calculate R using Ohm's Law for the last column.



#	measured R (Ω)	voltage(V)	current (A)	Calculated R(Ω) (powered)
1				
2				
3				
Total	Not measurable	V_T reading	A_T reading	$R_T = V_T / I_T$

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- Compare the measured resistance and resistance under power to the results from part I. Describe any differences or similarities in the relationship and explain what you think is happening.
- What is the relationship between the total resistance and the individual resistances? Total current and the individual currents? Total voltage and the individual voltages?
- Write a paragraph explaining what you think is happening in series circuits to cause the above relationships to occur. (*You made a similar circuit with light bulbs using CCK. You may want to experiment with the sim again, keeping in mind that light bulbs are just resistors that glow.*)

IV. Parallel Circuits

Wire the circuit in figure 1 with the same resistors. Take readings in different places shown in figure 2 by moving the multimeter. Make a table like the one below, calculating R using Ohm's Law for the last column.

Resistor number	measured $R(\Omega)$	Voltage (V)	Current(A)	Calculated $R(\Omega)$ (powered)
1				
2				
3				
Total	Not measurable	V_T reading	A_T reading	$R_T = V_T / I_T$

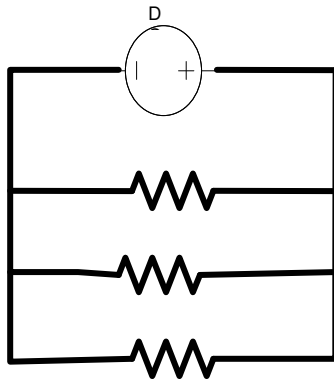


Figure 1

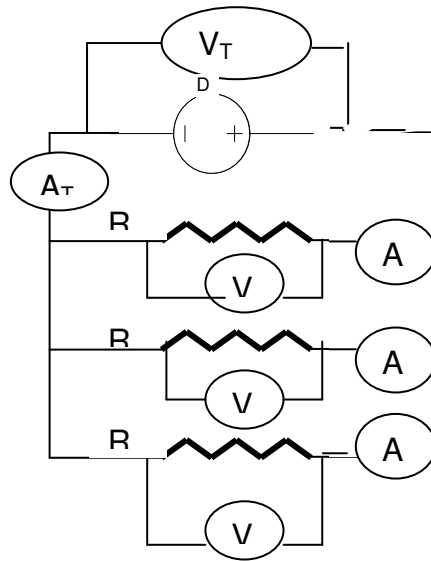


Figure 2

- Check your ideas about measured versus powered resistance. Explain, using the data, how your ideas are supported or need to be modified.
- How is the total resistance related to the individual resistances? Explain what you think is happening.
- Look up the mathematical relationship for finding total resistance in a parallel circuit. Show that your data fits the equation.
- Imagine you and your friends are running in the neighborhood like electrons flowing through a circuit. Make up stories that would serve as analogies for a parallel versus series circuits. Share your stories with another group and see if they make sense.
- Summarize the similarities and differences between the series and parallel circuits. Include your reasoning about what you think is happening.